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Signed *Andrew Gensy*  
Dated 30 September 2003

16 OCT 2002

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1. Your reference

MMN/P0882

18OCT02 E756812-1 003037

2. Patent application number

(The Patent Office will fill in this part)

0224240.2

0.00-0224240.2

3. Full name, address and postcode of the or of each applicant (underline all surnames)

Basic Solutions Limited  
Soothill Manor  
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Batley, WF17 6EU

Patents ADP number (if you know it)

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

762021002

4. Title of the invention

Ice Melting

5. Name of your agent (if you have one)

Franks & Co

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

9 President Buildings, Savile Street East,  
Sheffield, S4 7UQ, United Kingdom

Patents ADP number (if you know it)

7451917002

7451917004

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Country

Priority application number  
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Date of filing  
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

Yes

- a) any applicant named in part 3 is not an inventor, or
  - b) there is an inventor who is not named as an applicant, or
  - c) any named applicant is a corporate body.
- See note (d))

DUPLICATE

## ICE MELTING

### Field of the Invention

The present invention relates to a urea based granule blend configured for  
5 ice-melting when in use and reducing granule caking when in storage.

### Background to the Invention

Urea (also termed carbamide) is the chief nitrogen containing end product  
of the animal protein metabolism in addition to being synthesised on a large scale  
10 for use as a fertiliser and as a raw material in the manufacture of urea based  
plastics. Further applications of urea include use in the manufacture of drugs and  
importantly here for melting ice on runways, driveways, paths and the like.

When used within fertilisers and de-icing compositions it is known to store  
15 and dispense urea in the form of granules, including specifically prills, such  
granules or prills being dispensed onto an agricultural field or iced road via a  
mechanical spreading device such a device commonly being towed by a vehicle.

A first problem associated with the use of urea based granules is their  
20 tendency to cake (the sticking together of neighbouring granules) resulting in a  
large mass of undispensible urea. Caking of urea granules is particularly acute  
when stored in a humid environment, water being the contributor to the observed  
caking phenomenon. Within the art there are various attempts to solve the  
problem of urea granules caking, for example US 3,299,132 discloses a process  
25 of tumbling a bed of urea within a pre-set temperature range for a pre-set time.  
Effectively, the urea granules are baked so as to provide a hardened outer  
surface, the resulting granules exhibiting reduced caking tendency. WO  
95/21689 discloses a method for producing a free-flowing or non-caking granule  
urea in the presence of a conditioning agent. The conditioning agent being a  
30 divalent metal oxide such as calcium oxide, magnesium oxide or zinc oxide.  
Further additions include the use of a granulating aid being a trivalent metal salt  
such as aluminum or ferric sulphate. Further, US 3,544,297 discloses an anti-

caking treatment for urea using polymerised resins. The method disclosed uses a finely divided plastic material of a thermal-setting or thermal-plastic type added to the urea granules. The plastic material provides abrasive entities inter-dispersed within the urea granules so as to break down and/or prevent caking.

5 CA 1,146,973 identifies various attempts to reduce caking including the addition of aqueous formaldehyde solution or of aqueous formaldehyde-urea condensates such as di-and trimethylol urea as disclosed in DE-OS 2,139,278 and DE-OS 2,825,039. However, use of formaldehyde solutions is in itself unsatisfactory as the production of urea granules involves the removal of water,

10 water being present within the formaldehyde solutions. CA 1,146,973 according to its primary teaching discloses a method of treatment of urea granules by various additives including dicyandiamide so as to prevent granule caking.

A second problem associated with the treatment of urea granules so as to

15 reduce granule caking when in storage is the reduction of the granules ice-melting property when in use. For example, of the prior art identified above US 3,544,297, WO 95/21689 and CA 1,146,973 provide additives to or methods of treatment of granule urea for use in fertilisers to prevent granule caking in storage. The inventors have found that such prior art additives to or treatments

20 of urea granules in order to reduce caking, being specific to the use of granule urea for fertilisers, reduces the ice-melting property of the urea granules below an acceptable effective level in order to de-ice a road, driveway, path or the like. Conversely, prior art associated with the ice-melting application of urea are directed to improving the ice-melting property whilst not addressing the problem

25 of granule caking during storage, US 5,482,639 being such an example.

A third problem associated with prior fertiliser specific anti-caking disclosures is the corrosive nature of the treated urea or the depositing of unwanted residues following the de-icing process. Moreover, the deposition of

30 corrosive compounds following the ice-melting process is also common to prior art methods of urea based ice-melting formulations as disclose in US 5,482,639.

What is required therefore is a urea based granule blend configured with enhanced ice-melting property when in use whilst retaining reducing granule caking properties when in storage. Further, there is a need for such a granule blend having said properties which is non-corrosive and does not deposit unwanted additives following ice-melting.

### Summary of the Invention

On realising the problems associated with prior art urea based de-icing methods and formulations the inventors provide a urea based granule blend configured for ice-melting when in use whilst having a reduced caking tendency when in storage. Further, a urea based granule blend is provided which is non-corrosive without the deposition of unwanted blend composites released during or after the ice-melting process.

According to a first aspect of the present invention is provide a urea based granule blend configured for ice-melting and reducing granule caking, said blend comprising:

substantially pure urea granules comprising an ice-melting property; and

formaldehyde coated urea granules configured for reducing granule caking;

wherein said blend is configured for said ice-melting when in use and reducing granule caking when in storage.

According to a second aspect of the present invention there is provided a method of preparing a urea based granule blend configured for ice-melting and reducing granule caking, said method comprising:

mixing substantially pure urea granules comprising an ice-melting property with formaldehyde coated urea granules configured for reducing granule caking;

wherein said blend is configured for said ice-melting when in use and reducing granule caking when in storage.

According to a third aspect of the present invention there is provided a  
5 method of ice-melting using a urea based granule blend, said method comprising:

10 mixing substantially pure urea granules comprising an ice-melting property with formaldehyde coated urea granules;

reducing a caking of said granules using said formaldehyde coated urea granules;

15 initiating said ice-melting using said substantially pure urea granules; and

activating said formaldehyde coated urea granules for ice-melting following said initiating of said ice-melting using said substantially pure urea granules.

**Detailed Description of the Best Mode for Carrying Out the Invention**

20 There will now be described by way of example the best mode contemplated by the inventors for carrying out the invention. In the following description numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent however, to one skilled in the art, that the present invention may be practiced without limitation to these  
25 specific details. In other instances, well known methods and structures have not been described in detail so as not to unnecessarily obscure the present invention.

Within this specification the term "substantially pure urea granules" includes pure urea granules and urea granules containing slight or trace amounts of  
30 impurities formed or retained within the granules during manufacture.

Within this specification the term "formaldehyde coated urea granules" includes urea granules containing formaldehyde, such formaldehyde being present to a large extent on the surface of the granules. This term also includes the coating of urea granules with gaseous formaldehyde and formaldehyde solution both treatments involving a degree of formaldehyde penetration within the granules.

The inventors provide an improved urea based formulation or blend, over those disclosed in the art, having enhanced ice-melting property, being comparable with pure urea whilst having reduced granule caking tendency by utilising a blend composition comprising a ratio of mixed substantially pure urea granules with treated urea granules. The inventors have found that by utilisation of formaldehyde coated urea granules or more generally formaldehyde containing urea granules, a reduced granule caking is observed during storage of the urea based blend. The benefits of using formaldehyde treated urea granules include:

- A reduced granule caking during storage resulting ultimately in a free flowing ice-melting urea based granule formulation supplied to the intended area.
- The deposition of unwanted deposits or hazardous chemicals is avoided through utilisation of the blend compositions specific to the present invention disclosed herein.

25

According to the specific implementation of the present invention substantially pure urea granules are mixed with formaldehyde containing, being preferably coated, urea granules, the resultant blend being configured for ice-melting and reducing caking. The urea based granules coated with formaldehyde also comprise an ice-melting property being less than the ice-melting property of the substantially pure urea granules, the activity observed by the inventors

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indicating the substantially pure urea granules initiate ice-melting which in turn activates the ice-melting property of the formaldehyde coated urea granules.

According to the specific implementation of the present invention  
5 substantially pure urea granules are simply mixed with formaldehyde coated urea granules in that the stored and dispensed granule blend comprises an inter-disbursed even mixture of both types of granules, such that all granules are either in direct or indirect contact with one another. The granule blend may then be configured for storage within a hand-held dispenser, a user of such a dispenser  
10 being able to dispense the granule blend from a suitable dispensing port or ports. Due to the free flowing action of the granule blend, by way of example, a shaking of the dispenser is sufficient to allow a dispensing of the urea based blend onto the desired area, such as roads or paths or steps or drives.

15 Through the utilisation of a urea based granule blend the inventors provide an ice-melting formulation with reduced granule caking tendency such that a ratio of the substantially pure urea granules to formaldehyde coated urea granules is adjustable so as to provide a formaldehyde coated urea granules rich blend optimised for substantially reducing granule caking during storage of the granule  
20 blend. Such a blend ratio would be advantageous in particularly humid environments where the air is saturated with moisture and considerable granule caking would otherwise be observed.

Conversely, the ratio of substantially pure urea granules to formaldehyde  
25 coated urea granules may be adjusted to provide a substantially pure urea granules rich blend being optimised for ice-melting. Such a blend configuration would be advantageous in a particularly cold environment where substantial ice-melting is required.

30 According to the specific implementation of the present invention the blend ratio is 1:1, substantially pure urea granules to formaldehyde coated urea granules.



Preferably, the urea based granules are formed as prills being of a suitable length and diameter to allow ease of dispensing from a hand-held dispenser onto roads, paths, steps or drives. Further specific implementations of the present invention are configurable for use in commercial or industrial applications involving a variety of prill length and diameters.

Through the specific blend of urea based granules according to the present invention the free flowing nature of the ice-melting composition provides for a dispensing of the granule blend without requirement of a mechanical granule dispensing device being, for example a hopper or mechanical spreading device towed behind a vehicle.

According to the specific implementation of the present invention the urea based granule blend may be prepared being configured for ice-melting and reducing granule caking comprising mixing substantially pure urea granules comprising an ice-melting property with the formaldehyde coated urea granules configured for reducing granule caking. The granule blend is then configurable for storage in a hand-held dispenser being, by way of example, a canister, tube, tub, shaker or flask provided with at least one suitable dispensing orifice to allow the free flowing substantially pure urea granules plus formaldehyde coated urea granules to be dispensed onto the appropriate area.

When in use, the substantially pure urea granules initiate the ice-melting owing to their enhanced ice-melting capacity over that of the formaldehyde coated urea granules. On melting the ice water is produced which acts to solvate the formaldehyde from the formaldehyde coated urea granules thereby activating the formaldehyde coated urea granules for ice-melting following this initiating of the ice-melting using the substantially pure urea granule. A conversion of formaldehyde coated urea granules to substantially pure urea granules is then observed the newly generated substantially pure urea granules being configured for ice-melting.

The substantially pure urea granules can be said to catalyse the ice-melting by the formaldehyde coated urea granules, in that substantially pure urea granules are generated following an initial ice-melting.

**Claims:**

1. A urea based granule blend configured for ice-melting and reducing granule caking, said blend comprising:

5 substantially pure urea granules comprising an ice-melting property; and

formaldehyde coated urea granules configured for reducing granule caking;

10 wherein said blend is configured for said ice-melting when in use and reducing granule caking when in storage.

2. The granule blend as claimed in claim 1 wherein said formaldehyde coated urea granules comprise an ice-melting property being less than said ice-melting property of said substantially pure urea granules;

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wherein in use said substantially pure urea granules initiate said ice-melting thereby activating said ice-melting property of said formaldehyde coated urea granules.

20 3. The granule blend as claimed in claims 1 or 2 wherein said granule blend is configured for storage within a hand-held dispenser, said hand-held dispenser being configured to dispense said granule blend.

25 4. The granule blend as claimed in claim 3 wherein said granule blend is configured to be free-flowing from said dispenser.

5. The granule blend as claimed in any preceding claim wherein a ratio of said substantially pure urea granules to said formaldehyde coated urea granules is adjustable to provide a formaldehyde coated urea granules rich blend  
30 being optimised for substantially reducing granule caking during storage of said granule blend.

6. The granule blend as claimed in any preceding claim wherein a ratio of said substantially pure urea granules and said formaldehyde coated urea granules is adjustable to provide a substantially pure urea granules rich blend being optimised for said ice-melting.

5

7. The granule blend as claimed in any preceding claim wherein said substantially pure urea granules catalyse said ice-melting by said formaldehyde coated urea granules.

10

8. The granule blend as claimed in any preceding claim wherein said granules are prills.

9. The granule blend as claimed in any preceding claim wherein said granule blend is configured for ice-melting on paths or steps or drives.

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10. The granule blend as claimed in any preceding claim wherein said granule blend is configured for dispensing without requirement of a mechanical granule dispensing device.

20

11. A method of preparing a urea based granule blend configured for ice-melting and reducing granule caking, said method comprising:

mixing substantially pure urea granules comprising an ice-melting property with formaldehyde coated urea granules configured for reducing granule caking;

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wherein said blend is configured for said ice-melting when in use and reducing granule caking when in storage.

30

12. The method as claimed in claim 11 further comprising:

storing said granule blend in a hand-held dispenser configured to dispense said granule blend.

13. The method as claimed in claim 12 further comprising:

dispensing said granule blend from said hand-held dispenser by a shaking of said dispenser by a user.

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14. The method as claimed in any one of claims 11 to 13 further comprising:

adjusting a ratio of said substantially pure urea granules to said formaldehyde coated urea granules so as to provide said granule blend being optimised for reducing granule caking during granule blend storage, said granule blend being formaldehyde coated urea granules rich.

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15. The method as claimed in any one of claims 11 to 13 further comprising:

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adjusting a ratio of said substantially pure urea granules to said formaldehyde coated urea granules so as to provide said granule blend being optimised for ice-melting, said granule blend being substantially pure urea granules rich.

20

16. The method as claimed in any one of claims 11 to 15 wherein said granules are prills.

17. A method of ice-melting using a urea based granule blend, said method comprising:

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mixing substantially pure urea granules comprising an ice-melting property with formaldehyde coated urea granules;

30

reducing a caking of said granules using said formaldehyde coated urea granules;

initiating said ice-melting using said substantially pure urea granules; and

activating said formaldehyde coated urea granules for ice-melting following  
said initiating of said ice-melting using said substantially pure urea granules.

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18. The method as claimed in claim 17 wherein said initiating ice-melting and said activating said formaldehyde coated urea granules comprises:

melting ice using said substantially pure urea granules;

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solvating formaldehyde from said formaldehyde coated urea granules using  
water generated from said ice-melting;

generating substantially pure urea granules from said formaldehyde coated  
15 urea granules following said solvation of said formaldehyde; and

melting ice using said substantially pure urea granules generated from said  
formaldehyde coated urea granules.

20

19. The method as claimed in claims 17 or 18 further comprising:

storing said granule blend in a dispenser; and

dispensing said granule blend as a free-flowing granule blend from said  
25 dispenser.

30

20. The method as claimed in claim 19 wherein said dispenser is a  
hand-held dispenser, said dispensing of said granule blend from said dispenser  
comprising:

a user shaking said hand-held dispenser.

21. The method as claimed in any one of claims 17 to 20 further comprising:

optimising said granule blend for ice-melting by:

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adjusting a ratio of said substantially pure urea granules to said formaldehyde coated urea granules to provide a substantially pure urea granules rich granule blend.

10 22. The method as claimed in any one of claims 17 to 21 further comprising:

optimising said granule blend for reducing granule caking during granule blend storage by:

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adjusting a ratio of said substantially pure urea granules to said formaldehyde coated urea granules to provide a formaldehyde coated urea granules rich granule blend.

20 23. The method as claimed in any one of claims 17 to 22 wherein said granules are prills.

24. The method as claimed in any one of claims 17 to 23 further comprising:

25

melting ice using said granule blend on paths or steps or drives.

**Abstract**

**ICE MELTING**

5 A urea based granule blend configured for ice-melting and reducing granule caking, the blend comprising substantially pure urea granules comprising an ice-melting property and formaldehyde coated urea granules configured for reducing granule caking, wherein the blend is configured for ice-melting when in use and reducing granule caking when in storage.

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